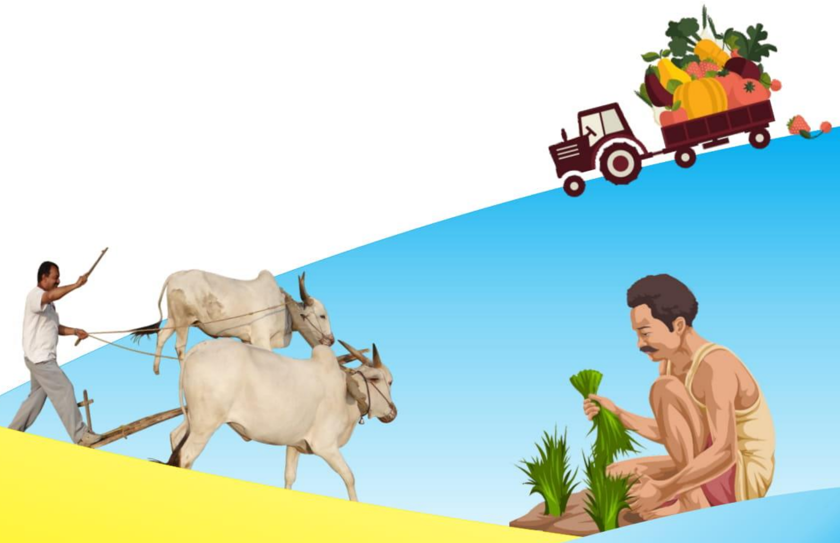
Indian Agritural:
Growth, Generation, Policy & Problem

By Ramesh Kumar P



Farmers is the only our Life in future

Indian Agricultural:

Growth, Generation, Policy & Problem

Book by Ramesh Kumar P

Features:

- **Monsoon in India and in other nations.**
- **Irrigation in India and in other nations.**
- **Land reforms in India**
- **Agricultural policy in India**
- **Food policy in India**
- **Agricultural contribution to economic growth.**
- **Agriculture soil pollution**
- **Agricultural productivity**

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Dear Readers,

As the RK Umarlai Khalsa, I would like to share some events, that RK Umarlai Khalsa started in the year 2015. In the year 2016, we had launched an online social media network. In the year 2018, the first book sciencewood was published.

The book Indian Agricultural Policy is written by the author Ramesh Kumar P. He had adopted huge information from other books and with the help of the Internet when he was studying in the College.

In this book (Indian Agricultural Policy), readers are going to gain a huge knowledge about the agricultural economics subject.

We are trying to our best to publish this book on all the platform of Digital world. Many of our innovations and experiment across the web, email, and app have been specified in the social media that cover RK Umarlai Khalsa. We hope it's apparent how committed we are to providing you with credible, interesting, and important information in a frictionless and enjoyable way as possible. At last I mention my sincere thanks and acknowledgment to author Ramesh Kumar P who had provided a huge and brief detail about the topics. I feel very happy that this book could be brought out despite may odd. We hope to bring out the other books in the future soon. We fondly hope our effort will be well recorded by the warm and enthusiastic response of our esteemed readers.

Massage,

It gives me great pride and pleasure in bringing to you Indian Agricultural Policy Book online.

I sincerely believe these Book will satisfy the need of all reader.

Best Regard;

RK Umarlai Khalsa

Evergreen quotes

"Look at the sky. We are not alone. The whole universe is friendly to us and conspires only to give the best to those who dream and work".

- A. P. J. Abdul Kalam (Former President of India)

"Where can we go to find God if we cannot see Him in our own hearts and in every living being".

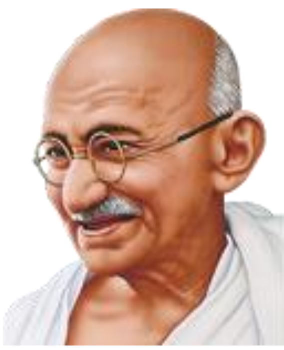
- Swami Vivekananda (Indian monk)

"You must not lose faith in humanity. Humanity is an ocean; if a few drops of the ocean are dirty, the ocean does not become dirty".

- Mohandas Karamchand Gandhi (Indian activist)

"Education is top most important weapon in the Universe that can kill poverty"

- Ramesh Kumar P (Author & Publisher)



Content

01. Introduction

Agriculture is the cultivation of land and breeding of animals and plants to provide food, fiber, medicinal plants and other products to sustain and enhance life. The study of agriculture is known as agricultural science.

The Agriculture sector plays a vital role in the Indian Economy. Agriculture contributes about 17.32% (2018) of total GDP. Over 70 per cent of the rural households depend on agriculture and provides employment to over 60% of the population.

In India the following types of farming are practiced:

- Shifting Agriculture (Jhoom)
- Subsistence Agriculture
- Intensive Farming
- Extensive Farming
- Plantation Agriculture
- Commercial Agriculture
- Dry Land Farming
- Wet Land Farming

Agriculture provides employment opportunities for rural people on a large scale in underdeveloped and developing countries. It is an important source of livelihood. The rising agricultural surplus caused by increasing agricultural production and productivity tends to improve social welfare, particularly in rural areas.

Indian agriculture began by 9000 BCE as a result of early cultivation of plants, and domestication of crops and animals. Settled life soon followed with implements and techniques being developed for agriculture. Double monsoons led to two harvests being reaped in one year.

Indian products soon reached the world via existing trading networks and foreign crops were introduced to India. Plants and animals considered essential to their survival by the Indians came to be worshiped and venerated.

The middle ages saw irrigation channels reach a new level of sophistication in India and Indian crops affecting the economies of other regions of the world. Land and water management systems were developed with an aim of providing uniform growth. Despite some stagnation during the later modern era the independent Republic of India was able to develop a comprehensive agricultural programme.

Early history

The following below are the age group of agricultural periods in Indian history: -

1. Iron Age India (1500 BCE – 200 CE)
2. Early Common Era – High Middle Ages (200–1200 CE)
3. Late Middle Ages (1200–1526 CE)
4. Mughal Era (1526–1757 CE)
5. Colonial British Era (1757–1947 CE)
6. Republic of India (1947 CE onwards)

02. Agricultural contribution towards Indian economy

India ranks second worldwide in farm output. Agriculture and allied sectors like forestry, logging and fishing accounted for 17% of the GDP. The sector employed 49% of its total workforce in 2014. Agriculture accounted for 23% of GDP, and employed 59% of the country's total workforce in 2016. As the Indian economy has diversified and grown, agriculture's contribution to GDP has steadily declined from 1951 to 2011, yet it is still the country's largest employment source and a significant piece of its overall socio-economic development. Crop-yield-per-unit-area of all crops has grown since 1950, due to the special emphasis placed on agriculture in the five-year plans and steady improvements in irrigation, technology, application of modern agricultural practices and provision of agricultural credit and subsidies since the Green Revolution in India. However, international comparisons reveal the average yield in India is generally 30% to 50% of the highest average yield in the world. The states of Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Andhra Pradesh, Telangana, Bihar, West Bengal, Gujarat and Maharashtra are key contributors to Indian agriculture.

The role of agriculture for the development of an economy may be stated as below:

1. Contribution to National Income:

The economic history of many advanced countries tells us that agricultural prosperity contributed considerably in fostering economic advancement. It is correctly observed that, “The leading industrialized countries of today were once predominantly agricultural while the developing economies still have the dominance of agriculture and it largely contributes to the national income. In India, still 28% of national income comes from this sector.

2. Source of Food Supply:

Agriculture is the basic source of food supply of all the countries of the world—whether underdeveloped, developing or even developed. Due to heavy pressure of population in underdeveloped and developing countries and its rapid increase, the demand for food is increasing at a fast rate. If agriculture fails to meet the rising demand of food products, it is found to affect adversely the growth rate of the economy. Raising supply of food by agricultural sector has, therefore, great importance for economic growth of a country.

Increase in demand for food in an economy is determined by the following equation:

$D = P + 2g$

Here,

D stands for Annual Rate of Growth in demand for food.

P stands for Population Growth Rate.

g stands for Rate of Increase in per Capita Income.

2 stands for Income Elasticity of Demand for Agricultural Products.

3. Pre-Requisite for Raw Material:

Agricultural advancement is necessary for improving the supply of raw materials for the agro-based industries especially in developing countries. The shortage of agricultural goods has its impact upon on industrial production and a consequent increase in the general price level. It will impede the growth of the country's economy. The flour mills, rice shellers, oil & dal mills, bread, meat, milk products sugar factories, wineries, jute mills, textile mills and numerous other industries are based on agricultural products.

4. Provision of Surplus:

The progress in agricultural sector provides surplus for increasing the exports of agricultural products. In the earlier stages of development, an increase in the exports earning is more desirable because of the greater strains on the foreign exchange situation needed for the financing of imports of basic and essential capital goods.

Johnson and Mellor are of the opinion, "In view of the urgent need for enlarged foreign exchange earnings and the lack of alternative opportunities, substantial expansion of agricultural export production is frequently a rational policy even though the world supply—demand situation for a commodity is unfavorable."

5. Shift of Manpower:

Initially, agriculture absorbs a large quantity of labour force. In India still about 62% labour is absorbed in this sector. Agricultural progress permits the shift of manpower from agricultural to non-agricultural sector. In the initial stages, the diversion of labour from agricultural to non-agricultural sector is more important from the point of view of economic development as it eases the burden of surplus labour force over the limited land. Thus, the release of surplus manpower from the agricultural sector is necessary for the progress of agricultural sector and for expanding the non-agricultural sector.

6. Creation of Infrastructure:

The development of agriculture requires roads, market yards, storage, transportation railways, postal services and many others for an infrastructure creating demand for industrial products and the development of commercial sector.

7. Relief from Shortage of Capital:

The development of agricultural sector has minimized the burden of several developed countries who were facing the shortage of foreign capital. If foreign capital is available with the 'strings' attached to it, it will create another significant problem. Agriculture sector requires less capital for its development thus it minimizes growth problem of foreign capital.

8. Helpful to Reduce Inequality:

In a country which is predominantly agricultural and overpopulated, there is greater inequality of income between the rural and urban areas of the country. To reduce this inequality of income, it is necessary to accord higher priority to agriculture. The prosperity of agriculture would raise the income of the majority of the rural population and thus the disparity in income may be reduced to a certain extent.

9. Based on Democratic Notions:

If the agricultural sector does not grow at a faster rate, it may result in the growing discontentment amongst the masses which is never healthy for the smooth running of democratic governments. For economic development, it is necessary to minimize political as well as social tensions. In case the majority of the people have to be kindled with the hopes of prosperity, this can be attained with the

help of agricultural progress. Thus, development of agriculture sector is also relevant on political and social grounds.

10. Create Effective Demand:

The development of agricultural sector would tend to increase the purchasing power of agriculturists which will help the growth of the non-agricultural sector of the country. It will provide a market for increased production. In underdeveloped countries, it is well known that the majority of people depend upon agriculture and it is they who must be able to afford to consume the goods produced.

Therefore, it will be helpful in stimulating the growth of the non- agricultural sector. Similarly, improvement in the productivity of cash crops may pave the way for the promotion of exchange economy which may help the growth of non-agricultural sector. Purchase of industrial products such as pesticides, farm machinery etc. also provide boost to industrial dead out.

11. Helpful in Phasing out Economic Depression:

During depression, industrial production can be stopped or reduced but agricultural production continues as it produces basic necessities of life. Thus, it continues to create effective demand even during adverse conditions of the economy.

12. Source of Foreign Exchange for the Country:

Most of the developing countries of the world are exporters of primary products. These products contribute 60 to 70 per cent of their total export earnings. Thus, the capacity to import capital goods and machinery for industrial development depends crucially on the export earning of the agriculture sector. If exports of agricultural goods fail to increase at a sufficiently high rate, these countries are forced to incur heavy deficit in the balance of payments resulting in a serious foreign exchange problem.

However, primary goods face declining prices in international market and the prospects of increasing export earnings through them are limited. Due to this, large developing countries like India (having potentialities of industrial development) are trying to diversify their production structure and promote the exports of manufactured goods even though this requires the adoption of protective measures in the initial period of planning.

13. Contribution to Capital Formation:

Underdeveloped and developing countries need huge amount of capital for its economic development. In the initial stages of economic development, it is agriculture that constitutes a significant source of capital formation.

Agriculture sector provides funds for capital formation in many ways as:

- agricultural taxation,
- export of agricultural products,
- collection of agricultural products at low prices by the government and selling it at higher prices. This method is adopted by Russia and China,
- labour in disguised unemployment, largely confined to agriculture, is viewed as a source of investible surplus,
- transfer of labour and capital from farm to non-farm activities etc.

14. Employment Opportunities for Rural People:

Agriculture provides employment opportunities for rural people on a large scale in underdeveloped and developing countries. It is an important source of livelihood. Generally, landless workers and marginal farmers are engaged in non-agricultural jobs like handicrafts, furniture, textiles, leather, metal work, processing industries, and in other service sectors. These rural units fulfill merely local demands. In India about 70.6% of total labour force depends upon agriculture.

15. Improving Rural Welfare:

It is time that rural economy depends on agriculture and allied occupations in an underdeveloped country. The rising agricultural surplus caused by increasing agricultural production and productivity tends to improve social welfare, particularly in rural areas. The living standard of rural masses rises and they start consuming nutritious diet including eggs, milk, ghee and fruits. They lead a comfortable life having all modern amenities a better house, motor-cycle, radio, television and use of better clothes.

16. Extension of Market for Industrial Output:

As a result of agricultural progress, there will be extension of market for industrial products. Increase in agricultural productivity leads to increase in the income of rural population which is turn leads to more demand for industrial products, thus development of industrial sector.

03. Agricultural soil

Agricultural soil science studies the chemical, physical, biological, and mineralogical composition of soils as they relate to agriculture. Agricultural soil scientists develop methods that will improve the use of soil and increase the production of food and fiber crops. Emphasis continues to grow on the importance of soil sustainability. Soil degradation such as erosion, compaction, lowered fertility, and contamination continue to be serious concerns. They conduct research in irrigation and drainage, tillage, soil classification, plant nutrition, soil fertility, and other areas.

Soil Fertility

Agricultural soil scientists study ways to make soils more productive. They classify soils and test them to determine whether they contain nutrients vital to plant growth. Such nutritional substances include compounds of nitrogen, phosphorus, and potassium. If a certain soil is deficient in these substances, fertilizers may provide them. Agricultural soil scientists investigate the movement of nutrients through the soil, and the amount of nutrients absorbed by a plant's roots. Agricultural soil scientists also examine the development of roots and their relation to the soil. Some agricultural soil scientists try to understand the structure and function of soils in relation to soil fertility. They grasp the structure of soil as porous solid. The solid frames of soil consist of mineral derived from the rocks and organic matter originated from the dead bodies of various organisms. The pore space of the soil is essential for the soil to become productive. Small pores serve as water reservoir supplying water to plants and other organisms in the soil during the rain-less period. The water in the small pores of soils is not pure water; they call it soil solution. In soil solution, various plant nutrients derived from minerals and organic matters in the soil are there. This is measured through the cation exchange capacity. Large pores serve as water drainage pipe to allow the excessive water pass through the soil, during the heavy rains. They also serve as air tank to supply oxygen to plant roots and other living beings in the soil. In short, agricultural soil scientists see the soil as a vessel, the most precious one for us, containing all of the substances needed by the plants and other living beings on earth.

Soil Preservation

In addition, agricultural soil scientists develop methods to preserve the agricultural productivity of soil and to decrease the effects on productivity of erosion by wind and water. For example, a technique

called contour plowing may be used to prevent soil erosion and conserve rainfall. Researchers in agricultural soil science also seek ways to use the soil more effectively in addressing associated challenges. Such challenges include the beneficial reuse of human and animal wastes using agricultural crops; agricultural soil management aspects of preventing water pollution and the build-up in agricultural soil of chemical pesticides.

Kind of soil and their variables

Some soil variables of special interest to agricultural soil science are:

Soil texture or soil composition: Soils are composed of solid particles of various sizes. In decreasing order, these particles are sand, silt and clay. Every soil can be classified according to the relative percentage of sand, silt and clay it contains.

Aeration and porosity: Atmospheric air contains elements such as oxygen, nitrogen, carbon and others. These elements are prerequisites for life on Earth. Particularly, all cells (including root cells) require oxygen to function and if conditions become anaerobic, they fail to respire and metabolize. Aeration in this context refers to the mechanisms by which air is delivered to the soil. In natural ecosystems soil aeration is chiefly accomplished through the vibrant activity of the biota. Humans commonly aerate the soil by tilling and plowing, yet such practice may cause degradation. Porosity refers to the air-holding capacity of the soil. See also characterization of pore space in soil.

Drainage: In soils of bad drainage the water delivered through rain or irrigation may pool and stagnate. As a result, prevail anaerobic conditions and plant roots suffocate. Stagnant water also favors plant-attacking water molds. In soils of excess drainage, on the other hand, plants don't get to absorb adequate water and nutrients are washed from the porous medium to end up in groundwater reserves.

Water content: Without soil moisture there is no transpiration, no growth and plants wilt. Technically, plant cells lose their pressure (see osmotic pressure and turgor pressure). Plants contribute directly to soil moisture. For instance, they create a leafy cover that minimizes the evaporative effects of solar radiation. But even when plants or parts of plants die, the decaying plant matter produces a thick organic cover that protects the soil from evaporation, erosion and compaction. For more on this subject see mulch.

Water potential: Water potential describes the tendency of the water to flow from one area of the soil to another. While water delivered to the soil surface normally flows downward due to gravity, at some point it meets increased pressure which causes a reverse upward flow. This effect is known as water suction.

Horizonation: Typically found in advanced and mature soils, horizonation refers to the creation of soil layers with differing characteristics. It affects almost all soil variables.

Fertility: A fertile soil is one rich in nutrients and organic matter. Modern agricultural methods have rendered much of the arable land infertile. In such cases, soil can no longer support on its own plants with high nutritional demand and thus needs an external source of nutrients. However, there are cases where human activity is thought to be responsible for transforming rather normal soils into super-fertile ones.

Biota and soil biota: Organisms interact with the soil and contribute to its quality in innumerable ways. Sometimes the nature of interaction may be unclear, yet a rule is becoming evident: The amount and diversity of the biota is "proportional" to the quality of the soil. Clades of interest include bacteria, fungi, nematodes, annelids and arthropods.

Soil acidity or soil pH and cation-exchange capacity: Root cells act as hydrogen pumps and the surrounding concentration of hydrogen ions affects their ability to absorb nutrients. pH is a measure of this concentration. Each plant species achieves maximum growth in a particular pH range, yet the vast majority of edible plants can grow in soil pH between 5.0 and 7.5.

04. Government Initiative to agricultural reform

How the Modi government is shaping the future of farming and farmers

Under the agriculture minister Rajnath Singh, in 2004 for the first time in the history of independent as well as colonial India, a National Commission on Farmers (NCF) was set up by the Government of India for looking into the problems of farm families and suggesting methods for making farming more remunerative as well as attractive to the younger generation.

This commission’s report in 2006 not only contained suggestions for the advancement of agriculture but also for the economic wellbeing of farming families. An important goal set for farmers’ welfare by NCF is to improve the economic viability of farming by ensuring that farmers earn a “minimum net income” and that agricultural progress is measured by the advance made in improving that income.

Other significant goals include mainstreaming the human and gender dimension in all farm policies and programme and giving explicit attention to sustainable rural livelihoods; completing the unfinished agenda in land reforms and initiating comprehensive asset and Aquarian reforms; and developing a social security system and support services for farmers.

Furthermore, protecting and improving the land, water, biodiversity and climate resources essential for sustained advances in the productivity, profitability and stability of major farming systems by creating an economic stake in conservation. Strengthening the biosecurity of crops, farm animals, fish and forest trees would safeguard the work and income security of farmer families, and the health and trade security of the nation. Likewise, fostering community-centered food, water and energy security systems in rural India would help ensure nutrition security at the level of every child, woman and man.

In terms of the goal of attracting youth to farming, NCF suggests making it both intellectually stimulating and economically rewarding, by conferring the power and economy of scale to small and marginal farmers both in the production and post-harvest phases of farming. Emphasis is also put on restructuring agricultural curriculums and pedagogic methodologies for enabling every farm and home science graduate to become an entrepreneur and to make agricultural education gender sensitive.

Finally, there is the goal of making India a global outsourcing hub for the production and supply of inputs needed for sustainable agriculture, and products and processes developed through biotechnology and ICT.

But although the NCF report was submitted in 2006 very little action was taken until the present government headed by Prime Minister Narendra Modi took office. Fortunately, over the last four years, several significant decisions have been taken to improve the status and income of farmers.

Designation of the agriculture ministry as the agriculture and farmers' welfare ministry has stressed keeping farmers' welfare as the measure of agriculture progress. Issuance of soil health cards to all farmers has been critical because soil health is basic to plant health and plant health is basic to human health.

Both budgetary and non-budgetary resources have been allocated for promoting micro-irrigation through the Pradhan Mantri Krishi Sinchayee Yojana. Conservation and sustainable use of indigenous breeds of cattle is being encouraged through a Rashtriya Gokul Mission. The Prime Minister also inaugurated the first ever International Agrobiodiversity Congress.

Promotion of the electronic national agriculture market is helping bring together different agriculture markets. Likewise, the creation of Gramin Agriculture Markets will provide scope for direct sales to consumers in both retail and bulk form. Notable in this context is also the introduction of the Agricultural Produce and Livestock Marketing Act, 2017 and Agricultural Produce and Livestock Contract Farming Services Act, 2018 supported by electronic Negotiable Warehouse Receipt system for increased institutional credit to the farm sector.

Also notable is the determination of MSP on the basis of NCF recommendations and assured procurement at MSP of more crops. Integration of protein rich pulses and nutri-rich millets into welfare programme including PDS, mid-day meals and ICDS is important too.

Activities like apiculture, mushroom cultivation, bamboo production, agro-forestry, vermicomposting and agro-processing are being promoted to generate additional jobs and income for farm families. The prime minister has also suggested that we should develop methods by which farmers' income can be doubled within five years. Plus, several corpus funds are being set up to complete ongoing

irrigation productions, modernize the infrastructure in dairy cooperatives, and strengthen the adoption of inland and marine aquaculture.

Above all, the recent announcement of a remunerative price based essentially on the recommendation of NCF is a very important step to ensure the economic viability of farming. To underline, government has ensured in its notification that from kharif 2018 onwards MSP of the notified crops would be minimum of 150% of the cost of production; it ranges from 150-200% for coarse cereals.

As for farmers' agitations still continuing, a major demand is the waving of loans and the implementation of the NCF recommendations on MSP. Both these problems are now receiving attention and appropriate action.

These are only some of the steps being taken to realize the concept of Jai Kisan. If all the above schemes are implemented effectively by the state and central governments, the future of farming and farmers can be shaped to also help India become a leader in both food and nutrition security. In addition, the Prime Minister has launched a National Nutrition Mission with a three-year budget of Rs 9,000 crore. His emphasis on agriculture as the prime industry of rural India urges doing everything possible to make agriculture both a source of income and the pride of our nation.

05. Land Reforms

Land reform (also agrarian reform, though that can have a broader meaning) involves the changing of laws, regulations or customs regarding land ownership or Land Reform refers to efforts to reform the ownership and regulation of land. Land reform may consist of a government-initiated or government-backed property redistribution, generally of agricultural land. Land reform can, therefore, refer to transfer of ownership from the more powerful to the less powerful, such as from a relatively small number of wealthy (or noble) owners with extensive land holdings (e.g., plantations, large ranches, or agribusiness plots) to individual ownership by those who work the land. Such transfers of ownership may be with or without compensation; compensation may vary from token amounts to the full value of the land.

Land reform may also entail the transfer of land from individual ownership—even peasant ownership in smallholdings—to government-owned collective farms; it has also, in other times and places, referred to the exact opposite: division of government-owned collective farms into smallholdings. The common characteristic of all land reforms, however, is modification or replacement of existing institutional arrangements governing possession and use of land. Thus, while land reform may be radical in nature, such as through large-scale transfers of land from one group to another, it can also be less dramatic, such as regulatory reforms aimed at improving land administration.

Nonetheless, any revision or reform of a country's land laws can still be an intensely political process, as reforming land policies serves to change relationships within and between communities, as well as between communities and the state. Thus, even small-scale land reforms and legal modifications may be subject to intense debate or conflict.

Arguments in Favor of Land Reforms

Equity – now majority of land in India is enjoyed by a minority of landlords.

Inverse relationship between land size and efficiency – the smaller the land, better will be the productivity and efficiency.

Owner-cultivation is more efficient than share-cropping.

Arguments against land reforms

Many of the arguments in support of land reform speak to its potentially positive social and economic outcomes. Yet, as mentioned previously, land reform is an intensely political process. Thus, many of those opposed to land reform are nervous as to the underlying motivations of those initiating the reform. For example, some may fear that they will be disadvantaged or victimized as a result of the reforms. Others may fear that they will lose out in the economic and political power struggles that underlie many land reforms.

Other groups and individuals express concerns about land reforms focused on formalization of property rights. While the economic and social benefits of formalized land rights are often touted, some research suggests that such reforms are either ineffective or may cause further hardship or conflict.

Additional arguments against land reform focus on concerns over equity issues and potential elite capture of land, particularly in regards to reforms focused on greater land formalization. If improperly or inadequately implemented, critics worry that such reforms may further disadvantage marginalization groups such as indigenous communities or women. These concerns also lead to questions about the institutional capacity of governments to implement land reforms as they are designed. Even if a country does have this capacity, critics worry that corruption and patrimonialism will lead to further elite capture.

In looking at more radical reforms, such as large-scale land redistribution, arguments against reform include concerns that redistributed land will not be used productively and that owners of expropriated land will not be compensated adequately or compensated at all. Zimbabwe, again, is a commonly cited example of the perils of such large-scale reforms, whereby land redistribution contributed to economic decline and increased food insecurity in the country. In cases where land reform has been enacted as part of socialist collectivization, many of the arguments against collectivization more generally apply.

Land reform in India

Since its independence in 1947, there has been voluntary and state initiated/mediated land reforms in several states with dual objective of efficient use of land [3] and ensuring social justice. The most notable and successful example of land reforms are in the states of West Bengal and Kerala. Other than these state sponsored attempts of reforming land ownership and control, there was another attempt to bring changes in the regime which achieved limited success; famously known as Bhoodan movement (Government of India, Ministry of Rural Development 2003, Annex XXXIX). Some other research has shown that during the movement, in Vidarbha region, 14 percent of the land records are incomplete, thus prohibiting transfer to the poor. 24 percent of the land promised had never actually become part of the movement. The Gramdan which arguably took place in 160,000 pockets did not legalize the process under the state laws (Committee on Land Reform 2009, 77, Ministry of Rural Development).

After promising land reforms and elected to power in West Bengal in 1977, the Communist Party of India (Marxist) (CPI(M)) kept their word and initiated gradual land reforms, such as Operation Barga. The result was a more equitable distribution of land among the landless farmers, and enumeration of landless farmers. This has ensured an almost lifelong loyalty from the farmers and the communists were in power till 2011 assembly election.

n land reform in Kerala, the only other large state where the CPI(M) came to power, state administrations have actually carried out the most extensive land, tenancy and agrarian labour wage reforms in the non-socialist late-industrializing world. Another successful land reform program was launched in Jammu and Kashmir after 1947.

All in all, land reforms have been successful only in pockets of the country, as people have often found loopholes in the laws that set limits on the maximum area of land that is allowed to be held by any one person.

Goals

Land distribution has been part of India's state policy from the very beginning. Independent India's most revolutionary land policy was perhaps the abolition of the Zamindari system (feudal land holding practices). Land-reform policy in India had two specific objectives: "The first is to remove such impediments to increase in agricultural production as arise from the agrarian structure inherited from the past…The second object, which is closely related to the first, is to eliminate all elements of exploitation and social injustice within the agrarian system, to provide security for the tiller of soil and assure equality of status and opportunity to all sections of the rural population." (Government of India 1961 as quoted by Appu 1996)

Categories

There are four main categories of reforms:

Abolition of intermediaries (rent collectors under the pre-Independence land revenue system);

Tenancy regulation (to improve the contractual terms including security of tenure);

A ceiling on landholdings (to redistributing surplus land to the landless);

Attempts to consolidate disparate landholdings;

encouragement of cooperative joint farming;

settlement and regulation of tenancy.

States which implemented land reforms in India

Zamindari Abolition Act was passed by UP, Tamil Nadu, Bihar, Madhya Pradesh, etc. Surplus lands were confiscated from zamindars. As in Golaknath case, Supreme court ruled that the provisions of Zamindari Abolition act contradicted with Article 31 of Indian Constitution, the parliament took steps to repeal Article 31. Later Land Ceilings Act was passed by different states.

Successful legislation for redistribution of land with ceilings on private land property happened only in a few states. The most notable and successful land reforms happened in states of Kerala and West Bengal (Operation Barga). Only pockets of India like Jammu and Kashmir witnessed commendable steps in land reform but attempts in states like Andra Pradesh, Madya Pradesh and Bihar led to clashes within the communities. Though the Central land reforms committee has laid guidelines for land ceilings, there was purposeful delay in the implementation land reform policy in many states, giving gap for transactions to escape the tooth of land reform laws.

06. Green revolution

The Green Revolution, or Third Agricultural Revolution, is a set of research and technology transfer initiatives occurring between 1950 and the late 1960s, that increased agricultural production worldwide, particularly in the developing world, beginning most markedly in the late 1960s.The initiatives resulted in the adoption of new technologies, including high-yielding varieties (HYVs) of cereals, especially dwarf wheats and races, in association with chemical fertilizers and agro-chemicals, and with controlled water-supply (usually involving irrigation) and new methods of cultivation, including mechanization. All of these together were seen as a 'package of practices' to supersede 'traditional' technology and to be adopted as a whole.

Both the Ford Foundation and the Rockefeller Foundation were heavily involved. One key leader was Norman Borlaug, the "Father of the Green Revolution", who received the Nobel Peace Prize in 1970. He is credited with saving over a billion people from starvation. The basic approach was the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers.

The term "Green Revolution" was first used in a speech on 8 March 1968 by the administrator of the U.S. Agency for International Development (USAID), William S. Gaud, who noted the spread of the new technologies: "These and other developments in the field of agriculture contain the makings of a new revolution. It is not a violent Red Revolution like that of the Soviets, nor is it a White Revolution like that of the Shah of Iran. I call it the Green Revolution."

In 1961, India was on the brink of mass famine. Norman Borlaug was invited to India by the adviser to the Indian minister of agriculture Dr.M.S. S Swaminathan. Despite bureaucratic hurdles imposed by India's grain monopolies, the Ford Foundation and Indian government collaborated to import wheat seed from the International Maize and Wheat Improvement Center (CIMMYT). Punjab was selected

by the Indian government to be the first site to try the new crops because of its reliable water supply and a history of agricultural success. India began its own Green Revolution program of plant breeding, irrigation development, and financing of agrochemicals.

India soon adopted IR8 – a semi-dwarf rice variety developed by the International Rice Research Institute (IRRI) that could produce more grains of rice per plant when grown with certain fertilizers and irrigation. In 1968, Indian agronomist S.K. De Datta published his findings that IR8 rice yielded about 5 tons per hectare with no fertilizer, and almost 10 tons per hectare under optimal conditions. This was 10 times the yield of traditional rice. IR8 was a success throughout Asia, and dubbed the "Miracle Rice". IR8 was also developed into Semi-dwarf IR36.

In the 1960s, rice yields in India were about two tons per hectare; by the mid-1990s, they had risen to six tons per hectare. In the 1970s, rice cost about $550 a ton; in 2001, it cost under $200 a ton. India became one of the world's most successful rice producers, and is now a major rice exporter, shipping nearly 4.5 million tons in 2006.

Agricultural production and food security

Technologies

The Green Revolution spread technologies that already existed, but had not been widely implemented outside industrialized nations. Two kinds of technologies were used in the Green Revolution and aim at cultivation and breeding area respectively. The technologies in cultivation are targeted at providing excellent growing conditions, which included modern irrigation projects, pesticides, and synthetic nitrogen fertilizer. The breeding technologies aimed at improving crop varieties developed through the conventional, science-based methods available at the time. These technologies included hybrids, combining modern genetics with selections.

High-Yielding Varieties

The novel technological development of the Green Revolution was the production of novel wheat cultivars. Agronomists bred cultivars of maize, wheat, and rice that are generally referred to as HYVs or "high-yielding varieties". HYVs have higher nitrogen-absorbing potential than other varieties. Since cereals that absorbed extra nitrogen would typically lodge, or fall over before harvest, semi-dwarfing genes were bred into their genomes. A Japanese dwarf wheat cultivar Norin 10 developed by a Japanese agronomist Gonjiro Inazuka, which was sent to Orville Vogel at Washington State University by Cecil Salmon, was instrumental in developing Green Revolution wheat cultivars. IR8, the first widely implemented HYV rice to be developed by IRRI, was created through a cross between an Indonesian variety named "Peta" and a Chinese variety named "Dee-geo-woo-gen". In the 1960s, when a food crisis happened in Asia, the spread of HYV rice was aggravated intensely.

Dr. Norman Borlaug, who is usually recognized as the "Father of the Green Revolution", bred rust-resistant cultivars which have strong and firm stems, preventing them from falling over under extreme weather at high levels of fertilization. CIMMYT (Centro International de Mejoramiento de Maize y Trigo—International Center for Maize and Wheat Improvements) conducted these breeding programs and helped spread high-yielding varieties in Mexico and countries in Asia like India and Pakistan. These programs successfully led the harvest double in these countries.

HYVs significantly outperform traditional varieties in the presence of adequate irrigation, pesticides, and fertilizers. In the absence of these inputs, traditional varieties may outperform HYVs. Therefore, several authors have challenged the apparent superiority of HYVs not only compared to the traditional varieties alone, but by contrasting the monocultural system associated with HYVs with the polyculture system associated with traditional ones.

Production increases

Cereal production more than doubled in developing nations between the years 1961–1985. Yields of rice, maize, and wheat increased steadily during that period. The production increases can be attributed roughly equally to irrigation, fertilizer, and seed development, at least in the case of Asian rice.

While agricultural output increased as a result of the Green Revolution, the energy input to produce a crop has increased faster, so that the ratio of crops produced to energy input has decreased over time. Green Revolution techniques also heavily rely on chemical fertilizers, pesticides, herbicides, and defoliants and rely on machines, which as of 2014 rely on or are derived from crude oil, making agriculture increasingly reliant on crude oil extraction. Proponents of the Peak Oil theory fear that a future decline in oil and gas production would lead to a decline in food production or even a Malthusian catastrophe.

Effects on food security

The effects of the Green Revolution on global food security are difficult to assess because of the complexities involved in food systems.

The world population has grown by about five billion since the beginning of the Green Revolution and many believe that, without the Revolution, there would have been greater famine and malnutrition. India saw annual wheat production rise from 10 million tons in the 1960s to 73 million in 2006. The average person in the developing world consumes roughly 25% more calories per day now than before the Green Revolution. Between 1950 and 1984, as the Green Revolution transformed agriculture around the globe, world grain production increased by about 160%.

The production increases fostered by the Green Revolution are often credited with having helped to avoid widespread famine, and for feeding billions of people.

There are also claims that the Green Revolution has decreased food security for a large number of people. One claim involves the shift of subsistence-oriented cropland to cropland oriented towards production of grain for export or animal feed. For example, the Green Revolution replaced much of the land used for pulses that fed Indian peasants for wheat, which did not make up a large portion of the peasant diet.

Food security

Malthusian criticism

Some criticisms generally involve some variation of the Malthusian principle of population. Such concerns often revolve around the idea that the Green Revolution is unsustainable, and argue that humanity is now in a state of overpopulation or overshoot with regards to the sustainable carrying capacity and ecological demands on the Earth.

Although 36 million people die each year as a direct or indirect result of hunger and poor nutrition, Malthus's more extreme predictions have frequently failed to materialize. In 1798 Thomas Malthus made his prediction of impending famine. The world's population had doubled by 1923 and doubled again by 1973 without fulfilling Malthus's prediction. Malthusian Paul R. Ehrlich, in his 1968 book The Population Bomb, said that "India couldn't possibly feed two hundred million more people by 1980" and "Hundreds of millions of people will starve to death in spite of any crash programs. "Ehrlich's warnings failed to materialize when India became self-sustaining in cereal production in 1974 (six years later) as a result of the introduction of Norman Borlaug's dwarf wheat varieties.

However, Borlaug was well aware of the implications of population growth. In his Nobel lecture he repeatedly presented improvements in food production within a sober understanding of the context of population. "The green revolution has won a temporary success in man's war against hunger and deprivation; it has given man a breathing space. If fully implemented, the revolution can provide sufficient food for sustenance during the next three decades. But the frightening power of human reproduction must also be curbed; otherwise the success of the green revolution will be ephemeral only. Most people still fail to comprehend the magnitude and menace of the "Population Monster"...Since man is potentially a rational being, however, I am confident that within the next two decades he will recognize the self-destructive course he steers along the road of irresponsible population growth..."

Famine

To some modern Western sociologists and writers, increasing food production is not synonymous with increasing food security, and is only part of a larger equation. For example, Harvard professor

Amartya Sen wrote that large historic famines were not caused by decreases in food supply, but by socioeconomic dynamics and a failure of public action. Economist Peter Bow brick disputes Sen's theory, arguing that Sen relies on inconsistent arguments and contradicts available information, including sources that Sen himself cited. Bow brick further argues that Sen's views coincide with that of the Bengal government at the time of the Bengal famine of 1943, and the policies Sen advocates failed to relieve the famine.

Quality of diet

Some have challenged the value of the increased food production of Green Revolution agriculture. Miguel A. Altieri, (a pioneer of agroecology and peasant-advocate), writes that the comparison between traditional systems of agriculture and Green Revolution agriculture has been unfair, because Green Revolution agriculture produces monocultures of cereal grains, while traditional agriculture usually incorporates polycultures.

These monoculture crops are often used for export, feed for animals, or conversion into biofuel. According to Emile Frison of Bioversity International, the Green Revolution has also led to a change in dietary habits, as fewer people are affected by hunger and die from starvation, but many are affected by malnutrition such as iron or vitamin-A deficiencies. Frison further asserts that almost 60% of yearly deaths of children under age five in developing countries are related to malnutrition.

The strategies developed by the Green Revolution focused on fend off starvation and was very successful in raising overall yields of cereal grains, but did not give sufficient relevance to nutritional quality. High yield-cereal crops have low quality proteins, with essential amino acid deficiencies, are high in carbohydrates, and lack balanced essential fatty acids, vitamins, minerals and other quality factors.

High-yield rice (HYR), introduced since 1964 to poverty-ridden Asian countries, such as the Philippines, was found to have inferior flavour and be more glutinous and less savoury than their native varieties. This caused its price to be lower than the average market value.

In the Philippines the introduction of heavy pesticides to rice production, in the early part of the Green Revolution, poisoned and killed off fish and weedy green vegetables that traditionally coexisted in rice paddies. These were nutritious food sources for many poor Filipino farmers prior to the introduction of pesticides, further impacting the diets of locals.

Socioeconomic impacts

The transition from traditional agriculture, in which inputs were generated on-farm, to Green Revolution agriculture, which required the purchase of inputs, led to the widespread establishment of rural credit institutions. Smaller farmers often went into debt, which in many cases results in a loss of their farmland. The increased level of mechanization on larger farms made possible by the Green Revolution removed a large source of employment from the rural economy. Because wealthier farmers had better access to credit and land, the Green Revolution increased class disparities, with the rich–poor gap widening as a result. Because some regions were able to adopt Green Revolution agriculture more readily than others (for political or geographical reasons), interregional economic disparities increased as well. Many small farmers are hurt by the dropping prices resulting from increased production overall. However, large-scale farming companies only account for less than 10% of the total farming capacity. This is a criticism held by many small producers in the food sovereignty movement.

The new economic difficulties of small holder farmers and landless farm workers led to increased rural-urban migration. The increase in food production led to a cheaper food for urban dwellers, and the increase in urban population increased the potential for industrialization.

According to a 2018 paper, a 10 percentage points increase in the use of high-yielding crop varieties in developing countries in the period 1960-2000 led to increases in GDP per capita of approximately 15 percent.

Environmental impact

Increased use of irrigation played a major role in the green revolution.

Biodiversity

The spread of Green Revolution agriculture affected both agricultural biodiversity and wild biodiversity. There is little disagreement that the Green Revolution acted to reduce agricultural biodiversity, as it relied on just a few high-yield varieties of each crop.

This has led to concerns about the susceptibility of a food supply to pathogens that cannot be controlled by agrochemicals, as well as the permanent loss of many valuable genetic traits bred into traditional varieties over thousands of years. To address these concerns, massive seed banks such as Consultative Group on International Agricultural Research's (CGIAR) International Plant Genetic Resources Institute have been established (see Svalbard Global Seed Vault).

There are varying opinions about the effect of the Green Revolution on wild biodiversity. One hypothesis speculates that by increasing production per unit of land area, agriculture will not need to expand into new, uncultivated areas to feed a growing human population. However, land degradation and soil nutrients depletion have forced farmers to clear up formerly forested areas in order to keep up with production. A counter-hypothesis speculates that biodiversity was sacrificed because traditional systems of agriculture that were displaced sometimes incorporated practices to preserve wild biodiversity, and because the Green Revolution expanded agricultural development into new areas where it was once unprofitable or too arid. For example, the development of wheat varieties tolerant to acid soil conditions with high aluminium content, permitted the introduction of agriculture in sensitive Brazilian ecosystems such as Cerrado semi-humid tropical savanna and Amazon rainforest in the geo-economics microregions of Centro-Sul and Amazônia. Before the Green Revolution, other Brazilian ecosystems were also significantly damaged by human activity, such as the once 1st or 2nd main contributor to Brazilian megadiversity Atlantic Rainforest (above 85% of deforestation in the 1980s, about 95% after the 2010s) and the important xeric shrublands called Caatinga mainly in North-eastern Brazil (about 40% in the 1980s, about 50% after the 2010s — deforestation of the Caatinga biome is generally associated with greater risks of desertification). This also caused many animal species to suffer due to their damaged habitats.

Nevertheless, the world community has clearly acknowledged the negative aspects of agricultural expansion as the 1992 Rio Treaty, signed by 189 nations, has generated numerous national Biodiversity Action Plans which assign significant biodiversity loss to agriculture's expansion into new domains.

The Green Revolution has been criticized for an agricultural model which relied on a few staple and market profitable crops, and pursuing a model which limited the biodiversity of Mexico. One of the critics against these techniques and the Green Revolution as a whole was Carl O. Sauer, a geography professor at the University of California, Berkeley. According to Sauer these techniques of plant breeding would result in negative effects on the country's resources, and the culture:

"A good aggressive bunch of American agronomists and plant breeders could ruin the native resources for good and all by pushing their American commercial stocks… And Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly... Unless the Americans understand that, they'd better keep out of this country entirely. That must be approached from an appreciation of native economies as being basically sound".

Greenhouse gas emissions

According to a study published in 2013 in PNAS, in the absence of the crop germplasm improvement associated with the Green Revolution, greenhouse gas emissions would have been 5.2-7.4 Gt higher than observed in 1965–2004. High yield agriculture has dramatic effects on the amount of carbon cycling in the atmosphere. The way in which farms are grown, in tandem with the seasonal carbon cycling of various crops, could alter the impact carbon in the atmosphere has on global warming. Wheat, rice, and soybean crops account for a significant amount of the increase in carbon in the atmosphere over the last 50 years.

Dependence on non-renewable resources

Most high intensity agricultural production is highly reliant on non-renewable resources. Agricultural machinery and transport, as well as the production of pesticides and nitrates all depend on fossil fuels. Moreover, the essential mineral nutrient phosphorus is often a limiting factor in crop cultivation, while phosphorus mines are rapidly being depleted worldwide. The failure to depart from these non-sustainable agricultural production methods could potentially lead to a large scale collapse of the current system of intensive food production within this century.

Health impact

The consumption of the pesticides used to kill pests by humans in some cases may be increasing the likelihood of cancer in some of the rural villages using them. Poor farming practices including non-compliance to usage of masks and over-usage of the chemicals compound this situation.[73] In 1989, WHO and UNEP estimated that there were around 1 million human pesticide poisonings annually. Some 20,000 (mostly in developing countries) ended in death, as a result of poor labelling, loose safety standards etc.

Pesticides and cancer

Contradictory epidemiologic studies in humans have linked phenoxy acid herbicides or contaminants in them with soft tissue sarcoma (STS) and malignant lymphoma, organochlorine insecticides with STS, non-Hodgkin's lymphoma (NHL), leukaemia, and, less consistently, with cancers of the lung and breast, organophosphorus compounds with NHL and leukaemia, and triazine herbicides with ovarian cancer.

07. Irrigation in India

Irrigation in India includes a network of major and minor canals from Indian rivers, groundwater well based systems, tanks, and other rainwater harvesting projects for agricultural activities. Of these groundwater systems is the largest. In 2013-14, only about 47.7% of total agricultural land in India was reliably irrigated. The largest canal in India is Indira Gandhi Canal, which is about 650 km long. About 2/3rd cultivated land in India is dependent on monsoons. Irrigation in India helps improve food security, reduce dependence on monsoons, improve agricultural productivity and create rural job opportunities. Dams used for irrigation projects help produce electricity and transport facilities, as well as provide drinking water supplies to a growing population, control floods and prevent droughts.

Ancient India

The Veda mentions only well-style irrigation, where kupa and avata wells once dug are stated to be always full of water, from which varatra (rope strap) and cakra (wheel) pull kosa (pails) of water. This water was, state the Vedas, led into surmi susira (broad channels) and from there into khanitrima (diverting channels) into fields.

Later, the 4th-century BCE Indian scholar Panini, mentions tapping several rivers for irrigation. The mentioned rivers include Sindhu, Suvastu, Varnu, Sarayu, Vipas and Chandrabhaga. Buddhist texts from the 3rd century BCE also mention irrigation of crops. Texts from the Maurya Empire era (3rd century BCE) mention that the state raised revenue from charging farmers for irrigation services from rivers.

Patanjali, in Yogasutra of about the 4th century CE, explains a technique of yoga by comparing it to "the way a farmer diverts a stream from an irrigation canal for irrigation". In Tamil Nadu, the Grand Anicut (canal) across the Kaveri river was implemented in the 3rd century CE, and the basic design is still used today.

Islamic era

Waterworks were undertaken during the Delhi Sultanate and the Mughal Empire era from the 12th to 18th centuries. However, these were primarily to supply water to the palaces and parks of the sultans and other officials.

Colonial era

In 1800, some 800,000 hectares was irrigated in India. The British Raj by 1940 built significant number of canals and irrigation systems in Uttar Pradesh, Bihar, Punjab, Assam and Orissa. The Ganges Canal reached 350 miles from Haridwar to Kanpur in Uttar Pradesh. In Assam, a jungle in 1840, by 1900 had 4,000,000 acres under cultivation, especially in tea plantations. In all, the amount of irrigated land multiplied by a factor of eight. Historian David Gilmour states British colonial government had built irrigation network with Ganges canal and that, "by the end of the century the new network of canals in the Punjab" were in place.

Much of the increase in irrigation during British colonial era was targeted at dedicated poppy and opium farms in India, for exports to China. Poppy cultivation by the British Raj required reliable, dedicated irrigation system. Large portions of the eastern and northern regions of India, namely United Provinces, North-western Provinces, Oudh, Behar, Bengal and Rewa were irrigated to ensure reliable supply of poppy and opium for China. By 1850, the Asian opium trade created nearly 1,000 square kilometres of poppy farms in India in its fertile Ganges plains, which increased to over 500,000 acres by 1900. This diversion of food crop land to cash crop use, state scholars, led to massive famines over the 1850 to 1905 period.

Major irrigation canals were built after millions of people died each in a series of major famines in the 19th century in British India. In 1900, British India (including Bangladesh and Pakistan) had about 13 million ha under irrigation. In 1901 the Viceroy, Lord Curzon, appointed a Commission chaired by Sir Colin Scott-Moncrieff to draw up a comprehensive irrigation plan for India. In 1903 the Commission's report recommended irrigation of an additional 2.6 million hectares. By 1947, the irrigated area had increased to about 22 million. In North-western British India region alone, with the colonial government's effort, 2.2 million hectares of previously barren land was irrigated by 1940s, most of which is now part of Pakistan. Arthur Cotton led some irrigation canal projects in the Deccan

peninsula, and landmarks are named after him in Andhra Pradesh and Tamil Nadu. However, much of the added irrigation capacity during the colonial era was provided by groundwater wells and tanks, operated manually.

Irrigation trends since 1947

India's irrigation covered crop area was about 22.6 million hectares in 1951, and it increased to a potential of 90 mha at the end of 1995, inclusive of canals and groundwater wells. However, the potential irrigation relies of reliable supply of electricity for water pumps and maintenance, and the net irrigated land has been considerably short. According to 2001/2002 Agriculture census, only 58.1 million hectares of land was actually irrigated in India. The total arable land in India is 160 million hectares (395 million acres). According to the World Bank, only about 35% of total agricultural land in India was reliably irrigated in 2010.

The ultimate sustainable irrigation potential of India has been estimated in a 1991 United Nations' FAO report to be 139.5 million hectares, comprising 58.5 mha from major and medium river-fed irrigation canal schemes, 15 mha from minor irrigation canal schemes, and 66 mha from groundwater well fed irrigation.

India's irrigation is mostly groundwater well based. At 39 million hectares (67% of its total irrigation), India has the world's largest groundwater well equipped irrigation system (China with 19 mha is second, USA with 17 mha is third).

India has spent ₹ 16,590 crore on irrigation development between 1950 and 1985. Between 2000-2005 and 2005-2010, India proposed to invest a sum of ₹ 1,03,315 crore and 2,10,326 crores on irrigation and flood control in India.

state wise irrigation types, capacity and actual

State	Total crop area (million hectares)	Groundwater irrigation crop area (million hectares)	Canal irrigation crop area (million hectares)	Total crop area actually irrigated (million hectares)
Andhra Pradesh	14.3	2.5	2.7	4.9
Arunachal Pradesh	0.4		0.07	0.05
Assam	3.0	0.13	0.1	0.22
Bihar	6.4	2.2	1.3	3.5
Chhattisgarh	5.1	0.17	0.74	0.85
Goa	0.1		0.1	0.1
Gujarat	9.9	3.1	0.5	3.2
Haryana	3.6	1.99	1.32	3.26
Himachal Pradesh	1.0	0.02	0.09	0.11
Jammu & Kashmir	0.9	0.02	0.38	0.37
Jharkhand	3.2	0.11	0.13	0.24
Karnataka	12.2	1.43	1.33	2.38
Kerala	1.5	0.18	0.21	0.39

Madhya Pradesh	15.8	2.74	1.70	4.19
Maharashtra	19.8	3.12	1.03	3.36
Manipur	0.2		0.05	0.05
Meghalaya	0.3		0.06	0.06
Mizoram	0.1		0.01	0.01
Nagaland	1.1		0.1	0.07
Odisha	4.9	0.17	1.07	1.24
Punjab	4.0	3.06	0.94	3.96
Rajasthan	21.1	3.98	1.52	5.12
Sikkim	0.1		0.01	0.01
Tamil Nadu	6.5	1.61	1.43	2.66
Tripura	0.3	0.02	0.05	0.07
Uttar Pradesh	17.6	10.64	4.21	14.49
Uttarakhand	0.8	0.22	0.14	0.35
West Bengal	5.5	2.09	1.22	2.98
All India	**159.6**	**39.43**	**22.48**	**58.13**

08. Food policy of Government

India's food policy evolved out of the Bengal famine of 1943 which killed more than a million people with starvation caused mainly by lack of adequate supplies of food grains than the lack of production. Food grains Policy Committee 1943 was appointed under the chairmanship of Sir George Theodore which emphasized rationing to overcome such situation in the future. Since then successive governments have been trying to enhance the level of food grain production in the country through offering minimum support prices to the farmers. In addition, PDS was evolved to safeguard the interest of the consumers particularly the more vulnerable section of the society. Aimed to curb the speculative price rise, simultaneously evolved price policy contained four major policy instruments; namely inputs subsidies; minimum support prices; procurement prices; and issue prices. They were devised to achieve the basic goal of the food security. Despite changes in contents and emphases over the years the basic goal of India's food policy could be summarized as follows;

1. Increase in food grain production.

2. Stabilizing food grain prices and

3. Maintaining adequate stocks of food grains as a measure of food security.

To attain the above-mentioned objective two central bodies namely the Food Corporation of India (FCI) and Agriculture Price Commission (APC) were established in 1965. The FCI was responsible for procurement, import, distribution, storage and the sale of food grain. While the APC was to control and guide the cropping pattern, land use and profitability through minimum support price mechanism. This policy continued till the dawn of the new economic reforms in 1991 when the World Bank, which had earlier designed these two centralized institutions called for dismantling them, besides advising the government of India to dismantle the PDS as well. The Bank also asked for the removal of the Essential Commodities Act, the removal of price and inventory control and deregulation of agricultural trade. Further, it recommended the corporatization of agriculture and a shift from a state-centered to a corporate-centered food system. recommended the corporatization of agriculture and a shift from a state-centered to a corporate-centered food system.

Radical restructuring of the PDS and withdrawal of food subsidies were the important aspects of India's structural adjustment programme that began in 1991. The Revamped PDS (RPDS), which started in 1992, was supposed to target particularly the vulnerable regions and sections besides curtailing the public expenditure. But the scheme not only failed in achieving its stated objective but also ended up aggravating both of them. Therefore, in 1997, the RPDS was replaced by the Targeted PDS (TPDS), which artificially divided the population into "Below Poverty Line" (BPL) and "Above Poverty Line" (APL). The APL category was defined as those earning Rs. 1500/month and above. Those falling in the APL category were subsequently asked to bear 100 percent of the procurement and distribution costs. Whereas those falling in the BPL category were provided 10 kg of wheat or rice a month at highly subsidized prices. The withdrawal of subsidies for families above poverty line (APL)

resulted food prices to rise substantially and beyond the reach of a large number of families. This took its toll on the offtake which fell substantially leading to unsurmounting stock of food grains. That is why the recent government committee established to formulate the long-term grain policy has recommended the prices of grain for APL families to be slashed by 25 percent. PDS expanded enormously after establishment of the Food Corporation of India (FCI) and the Agricultural Prices Commission (APC) now known as Commission for Agriculture Costs and Prices (CACP). Over the years, the amount of food grains distributed through the PDS has increased enormously. However, despite an extensive public distribution programme, the benefits quite often have not reached the people it was intended for. Simultaneously, the vulnerable producers who are growing rain-fed crops like jowar, bajra etc. could not benefit from the governments' policy of assuring ruminative prices. Added to this the fixed pricing policy of the government throughout the year for the purpose of procurement and distribution has increased the concentration of the market arrivals in a few months or the days of the month. High degree of concentration of market arrivals results disorderly marketing of the produce and make difficult, the handling of the large quantities of the grains purchased efficiently in a short post-harvest period by the FCI, as a result the difference of the economic cost of the FCI and the issue prices widened. At the same time size of the distribution continued enlarging year after year leading to much increase in the burden of the food subsidy on the exchequer. Despite the country reaching near self-sufficiency in food grains production, its continued policy of offering higher MSP has reached a limit where farmers are more interested in selling their produce to the Government then to the market, as a result the market prices of the food grains have increased to adversely affect the poor. Secondly, the stocks position has also gone beyond the desired level leading to heavy increase in the burden of the food subsidy. Government's decision to increase the issue prices of the food grains, to make up the deficit, have sharply reduced the offtake leading to further bulging of the stocks. It is noteworthy that after the SAP in 1991 the overall system of food management and public delivery was over hauled. Initially the RPDS was introduced with natron targeting and thereafter the RPDS was replaced by the TPDS in 1997. Unfortunately, both the schemes miserably failed in achieving their stated objectives of increasing the food grain availability among the poorest and reducing the government's food subsidy burden. It is important to note that after the structural adjustment programme the consumer food subsidy has fallen in real terms and since then has not changed much as a share of gross domestic product (GDP)." It is due to increases in intermediate costs and costs of procurement, storage, buffer-stock operations and transportation. Consequently, the burden of inefficiencies in the system of storage and distribution are being passed on to consumers in the form of higher prices. For example, between 1975 and 1989, the distribution costs of the Food Corporation of India (FCI) has increased by 274 percent whereas the procurement costs increased only by 70 percent. And in 1992-93 the per-quintal cost of procurement and distribution of the FCI was almost as high as the per quintal support price. Particularly, the period of structural adjustment saw a steep rise in the prices of food grains supplied through the public distribution system and the consequent decline in the offtake of the same. Following pages have some more details about India's evolving food policy since the World War II.

Institutions to Implement Agriculture Price Policy:

The Commission for Agricultural Cost and Prices (CACP)

This is a renewed version of the erstwhile Agricultural Price Commission (APC). It is the chief advisory body on agriculture price policy. While recommending a price for a commodity the commission takes into account, among other factors, the prices fixed in the previous year, trends in open market prices reflecting overall shortages or surplus, the latest available estimates of cost of production and changes in the input prices, the need for securing a balanced growth in the output of related crops, reduction in inter states price dispersion, the likely effect of the recommended prices on the cost of living and the general price level. At present, the main task of the commission is to recommend the procurement prices for principal crops although its terms of reference are quite comprehensive.

The Food Corporation of India (FCI):

The FCI was set up in 1964 through an act of parliament. Its primary responsibility is to undertake purchase, storage, transportation, distribution and sale of food grains. It also aims to ensure that the primary producer gets the minimum price set by the government and the consumer is protected from the vagaries of speculative trades. FCI has been the main filed instrument of the government of India's food policy since its establishment. On behalf of the government, it looks after the price support, procurement, storage, interstate movement and distribution operations of food grains. The FCI also provides price support to farmers by purchasing quantities that could not fetch minimum support prices in the market, stores the grains scientifically, moves grains from surplus to deficit areas and makes available grains to states for the purpose of public distribution system. On behalf of the central Government it is authorized to handle all purchase, storage, movement, distribution and sale of food grains besides engaging itself in import and export of food grains as and when necessary. Since April 1969, FCI is also acting as the sole agency of the central Government for state trading in food grains. It helps government to achieve the following objectives. 1. Guarantee of minimum support price to the producers. 2. Restrictions on the interstate movement of food grains by private traders. 3. Imports of food grains where necessary 4. The maintenance of Public Distribution System through statutory and other controls. 5. Building up of the required buffer stocks of grains.

The Role of the Food Corporation of India (FCI):

The Committee expressed satisfaction over the role FCI has performed over the years. However, it criticized the FCI for its predominant role in procuring from a few surplus states rather than ensuring price support to cultivators throughout the country and developing markets for grain in relatively underdeveloped regions. The Committee recommended additional budgetary support for FCI to perform its remaining tasks. Regarding the management of FCI, the Committee did not envisage any basic change in the structure of the FCI. But it called for giving the FCI greater operational flexibility in strengthening the market intelligence set-up and improving its management practices in procurement, storage and quality control. The Committee expressed dissatisfaction over the market intelligence set up of FCI, which in Committee's view, is extremely rudimentary and does not cater to data requirements on domestic and international prices for open market sales, purchases and release of

stocks for export. Thus, given the present crisis in the food grain management in the country, the Committee recommended for immediate and bold initiatives to correct the imbalances. In the opinion of the Committee, the existing measures taken by the government for the purpose of reducing stocks have pertained only to disposal and distribution and have not addressed the critical issue of procurement. In the committee's assessment, present level of stocks cannot be reduced unless there is corresponding reduction in procurement.

Public Distribution System (PDS):

Introduced in the wake of Bengal famine 1943, the PDS has come out to be the most important constituent of India's food policy. The need for a public distribution, as an effective instrument of price stabilization in the national economy was emphasized time and again in various food grains enquiry committee reports. Starting with Theodore Gregory's recommendation 1943, followed by Food grains Procurement Committee Report of 1950-51 asking for a controlled system of procurement and distribution of food grains. The Food grains Policy Committee 1966 laid emphasis on equitable distribution of food grains by making the surplus produces in surplus states available at reasonable prices to non-producing consumers as well as to the deficit states with prime objective to protect the low-income groups people from the adverse impact of food shortages. Thus. PDS has been outlined a vital role after the grains had been procured or imported for the distribution purposes. It is the joint responsibility of the central and state governments and union territories administrations to ensure the smooth functioning of public distribution system. While the responsibility of the central government is to procure, store and transport it from purchase points to central godowns, the responsibility of the state governments and union territory administrations is to lift these grains from the central godowns and distribute them to consumers through the network of fair price shops. Historically, the PDS has been functioning with the following objectives.

a. Maintaining price stability.

b. Raising the welfare of the poor by providing them access to basic foods at reasonable prices.

c. Rationing during scarcity situations and d. Keeping a check on private trades.

<u>Essential Constituents of the PDS</u>:

1. To collect sufficient quantities of food grains so as to able to distribute it throughout the year at reasonable prices, commensurate with the commitment and coverage either through the internal procurement or by imports to the extent of necessity.

2. To arrange for the adequate storage capacity at procurement and distribution centers for operational as well as buffer stocks.

3. To lay down the grain’s specification and quality control at various stages of procurement, storage and distribution.

4. To determine the issue prices of food grains, in consultation with the government in the light of the recommendation of the CACP, before the commencement of marketing season. Thus, fixing of the issue price is of crucial importance both from the point of view of regulating the market prices and of determining the size of the commitment undertaken through the PDS. It is also a vital force for maintaining prices at reasonable level.

Management of the Public Distribution System:

Under the existing division of the authority between central and states governments, Central Government through the FCl procures, transports and stores the food grains. On the other hand, state governments are liable to pick the food grains from FCI depots and make it available to the consumers through the network of fair price shops. A fair price shop covers a population of about 2000 of a particular village/ town or cities. The overall control of the public distribution system rests with the food and civil supplies department of the state government. All people whether rich or poor are entitled to draw supplies from fair price shops at fixed prices. The number of fair price shops has been increasing continuously over the years in both rural and urban areas. According to the civil supplies department about 25 percent of the fair price shops were run by cooperatives. The scale of PDS became massive as during the period of 1971 to 1990 public distribution of cereals ranged between 8.9 and 15 million tons per year. Over the years the share of PDS has varied from 9 to 15 percent of the total cereal production. The distribution is quite high during lean years and quite low when market prices are low. The quantities supplied through the PDS outlets remained below 5 million tones up to 1963 and thereafter they had gone up to 14 million tones by mid 1960s. Throughout the seventies the quantities remained around 10 million tones and during eighties the average was around 16 million tones. In the post reform period average distribution marginally improved to 17 million tones (table 5.23). PDS continues to be the major instrument of Governments' economic policy not only for ensuring food security but also for protecting purchasing power of the poor.

According to the Economic Survey, ‘’75 percent of the ration shops were located in rural areas. More than 70 percent of the PDS rice and more than 55 percent of the PDS wheat was sold in rural areas. The distribution of PDS was more effective in states like Gujarat, Kerala. Maharashtra, Tamil Nadu, Andhra Pradesh and West Bengal. There is a regular operation of PDS supplying the food at highly subsidized prices lo those living in the Integrated Tribal Development Project Areas. Different anti-poverty employment programme also distribute food grains as a part payment for wages to help the poor. These operations have caused subsidy on food to increase over the years. "

Miscellaneous Schemes:

Antyodaya Anna Yojna (AAY):

Introduced on 25 December 2001, the scheme aimed to identify 10 million poorest of the poor out of the total 65 million BPL families. Under this scheme selected families are provided 35 kg food grains per month at the Central Issue Price of Rs 2 per kg for wheat and Rs 3 per kg for rice. Initially the

scheme has been slow to take off in many states, however, with the passage of time scheme's performance has remarkably improved.

Mid-Day Meal Scheme:

The scheme was launched by the Ministry of Human Resource Development from August 15, 1995 for the benefit of students in primary schools in EAS/earlier RPDS blocks (2368). The Scheme covers students (Class I-V) in the Government Primary' Schools / Primary Schools aided by Govt, and the Primary Schools run by local bodies. Food grains (wheat and rice) are supplied free of cost @ 100 gram per child per school day where cooked/processed hot meal is being served with a Minimum content of 300 calories and 8-12 grams of protein each day of school for a minimum of 200 days and 3 kgs per student per month for 10 months in a year, where food grains are distributed in raw form.

Wheat Based Nutrition Programme (WBNP):

Launched under the auspices of the Department of Women & Child Development, Ministry of Human Resource Development, allotted food grains under the scheme are utilized by the States/UTs under Integrated Child Development Scheme (ICDS) for providing nutritious/ energy food to children below 6 years of age and expectant lactating women.

Scheme for Food grains to SC/ST/OBC:

Introduced in October 1994, the Ministry of Social Justice & Empowerment implements and monitors the scheme. The residents of the hostels having 2/3 students belonging to these categories are eligible to get 15 kg food grains per resident per month. Annapurna Scheme: The Ministry of Rural Development launched this scheme in 2001-2002 for indigent senior citizens or 65 years of age or above who though eligible for old age pension under the National Old Age Pension Scheme (NOAPS) but are not getting the pension are covered under the Scheme. 10 kgs of food grains per person per month are supplied free of cost under the scheme.

09. Monsoon in India

Monsoon

Monsoons typically occur in tropical areas. One area that monsoons impact greatly is India. In India monsoons create an entire season in which the winds reverse completely.

Various atmospheric conditions influence the monsoon winds. The first condition is the differential heating and cooling of land and water. This creates low pressure on the landmass, while high pressure is created over the seas during daytime, but is reversed during the night time.

The second condition is the shift in the position of Inter-Tropical Convergence Zone (ITCZ). In summer, the equatorial trough normally positioned about 5°N of the equator moves over the Ganga plain creating a monsoon trough during the monsoon season.

The third condition is the presence of the high-pressure area that develops east of Madagascar. It is approximately at 20°S over the Indian Ocean. The intensity and position of this high-pressure area affects the Indian Monsoon.

The fourth condition develops during the summer. The Tibetan Plateau gets intensely heated resulting in strong vertical air currents and high pressure over the plateau about 9 km above sea level. The fifth condition develops during the summer due to the movement of the westerly jet streams to the north of the Himalayas and the presence of the tropical easterly jet stream over the Indian Peninsula.

Changes in pressure over the southern oceans also affect the monsoons. In certain years, there is a reversal in the pressure conditions. This periodic change in pressure conditions is known as the Southern Oscillation, or SO.

The Southern Oscillation is connected to la Nina, which is a warm ocean current that flows past the Peruvian Coast. It flows every two to five years in place of the cold Peruvian current. The phenomenon is, referred to as ENSO (El Nino Southern Oscillations). In India, the monsoon lasts for 100 to 120 days from early June and to mid-September. The monsoon winds encounter various atmospheric conditions on their way and hence are pulsating in nature, and not steady.

The monsoon arrives with a sudden downpour of rainfall that continues for several days. This is known as the 'burst' of the monsoon.

The rainfall is a result of the convergence of wind flow from the Bay of Bengal and reverse winds from the South China Sea.

The onset of the monsoon occurs over the Bay of Bengal in May, arriving at the Indian Peninsula by June, and then the winds move towards the South China Sea. By early September, the monsoon starts to withdraw or retreat and is a more gradual process. By mid-October, it withdraws completely from the northern half of the peninsula. The withdrawal takes place progressively from north to south from the first week of December to the first week of January. This is the start of the winter season.

The retreating monsoon winds move over the Arabian Sea and the Bay of Bengal, and collect moisture on the way. These monsoon winds reach the southern states of India by October, and are responsible for a second round of rainfall. These are called the winter monsoons. The winter monsoon is experienced in the states of Karnataka, Tamil Nadu, Kerala and Andhra Pradesh in the first week of January.

Monsoon of South Asia

The monsoon of South Asia is among several geographically distributed global monsoons. It affects the Indian subcontinent, where it is one of the oldest and most anticipated weather phenomena and an economically important pattern every year from June through September, but it is only partly understood and notoriously difficult to predict. Several theories have been proposed to explain the origin, process, strength, variability, distribution, and general vagaries of the monsoon, but understanding and predictability are still evolving.

The unique geographical features of the Indian subcontinent, along with associated atmospheric, oceanic, and geophysical factors, influence the behavior of the monsoon. Because of its effect on agriculture, on flora and fauna, and on the climates of nations such as India, Nepal, Bangladesh, Bhutan, Pakistan, and Sri Lanka — among other economic, social, and environmental effects — the monsoon is one of the most anticipated, tracked, and studied weather phenomena in the region. It has a significant effect on the overall well-being of residents and has even been dubbed the "real finance minister of India"

Climate of India

The Climate of India comprises a wide range of weather conditions across a vast geographic scale and varied topography, making generalizations difficult. Based on the Köppen system, India hosts six major climatic subtypes, ranging from arid desert in the west, alpine tundra and glaciers in the north, and humid tropical regions supporting rainforests in the southwest and the island territories. Many regions have starkly different microclimates. The country's meteorological department follows the international standard of four climatological seasons with some local adjustments: winter (December, January and February), summer (March, April and May), a monsoon rainy season (June to September), and a post-monsoon period (October to November).

India's geography and geology are climatically pivotal: the Thar Desert in the northwest and the Himalayas in the north work in tandem to affect a culturally and economically important monsoonal regime. As Earth's highest and most massive mountain range, the Himalayas bar the influx of frigid katabatic winds from the icy Tibetan Plateau and northerly Central Asia. Most of North India is thus kept warm or is only mildly chilly or cold during winter; the same thermal dam keeps most regions in India hot in summer.

Though the Tropic of Cancer—the boundary between the tropics and subtropics—passes through the middle of India, the bulk of the country can be regarded as climatically tropical. As in much of the

tropics, monsoonal and other weather patterns in India can be wildly unstable: epochal droughts, floods, cyclones, and other natural disasters are sporadic, but have displaced or ended millions of human lives. There is one scientific opinion which states that in South Asia such climatic events are likely to change in unpredictability, frequency, and severity. Ongoing and future vegetative changes and current sea level rises and the attendant inundation of India's low-lying coastal areas are other impacts, current or predicted, that are attributable to global warming.

Winter, occurring from December to March. The year's coldest months are December and January, when temperatures average around 10–15 °C (50–59 °F) in the northwest; temperatures rise as one proceeds towards the equator, peaking around 20–25 °C (68–77 °F) in mainland India's southeast.

Summer or pre-monsoon season, lasting from April to June (April to July in northwestern India). In western and southern regions, the hottest month is April; for northern regions of India, May is the hottest month. Temperatures average around 32–40 °C (90–104 °F) in most of the interior.

Monsoon or rainy season, lasting from July to September. The season is dominated by the humid southwest summer monsoon, which slowly sweeps across the country beginning in late May or early June. Monsoon rains begin to recede from North India at the beginning of October. South India typically receives more rainfall.

Post-monsoon or autumn season, lasting from October to November. In the northwest of India, October and November are usually cloudless. Tamil Nadu receives most of its annual precipitation in the northeast monsoon season.

The Himalayan states, being more temperate, experience an additional season, spring, which coincides with the first weeks of summer in southern India. Traditionally, North Indians note six seasons or Ritu, each about two months long. These are the spring season (Sanskrit: vasanta), summer (grīṣma), monsoon season (varṣā), autumn (śarada), winter (hemanta), and prevernal season (śiśira). These are based on the astronomical division of the twelve months into six parts. The ancient Hindu calendar also reflects these seasons in its arrangement of months.

Winter

Once the monsoons subside, average temperatures gradually fall across India. As the Sun's vertical rays move south of the equator, most of the country experiences moderately cool weather. December and January are the coldest months, with the lowest temperatures occurring in the Indian Himalayas. Temperatures are higher in the east and south.

In northwestern India region, virtually cloudless conditions prevail in October and November, resulting in wide diurnal temperature swings; as in much of the Deccan Plateau, they register at 16–20 °C (61–68 °F). However, from January to February, "western disturbances" bring heavy bursts of rain and snow. These extra-tropical low-pressure systems originate in the eastern Mediterranean Sea. They

are carried towards India by the subtropical westerlies, which are the prevailing winds blowing at North India's range of latitude. Once their passage is hindered by the Himalayas, they are unable to proceed further, and they release significant precipitation over the southern Himalayas.

There is a huge variation in the climatic conditions of Himachal Pradesh due to variation in altitude (450–6500 metres). The climate varies from hot and subtropical humid (450–900 meters) in the southern low tracts, warm and temperate (900–1800 metres), cool and temperate (1900–2400 metres) and cold glacial and alpine (2400–4800 meters) in the northern and eastern elevated mountain ranges. By October, nights and mornings are very cold. Snowfall at elevations of nearly 3000 m is about 3 m and lasts from December start to March end. Elevations above 4500 m support perpetual snow. The spring season starts from mid February to mid April. The weather is pleasant and comfortable in the season. The rainy season starts at the end of the month of June. The landscape lushes green and fresh. During the season streams and natural springs are replenished. The heavy rains in July and August cause a lot of damage resulting in erosion, floods and landslides. Out of all the state districts, Dharamsala receives the highest rainfall, nearly about 3,400 mm (134 in). Spiti is the driest area of the state, where annual rainfall is below 50 mm. The five Himalayan states (Jammu and Kashmir in the extreme north, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh) along Northern West Bengal experience heavy snowfall, Manipur and Nagaland are not located in the Himalayas but experience occasional snowfall; in Jammu and Kashmir, blizzards occur regularly, disrupting travel and other activities.

The rest of North India, including the Indo-Gangetic Plain and Madhya Pradesh almost never receives snow. Temperatures in the plains occasionally fall below freezing, though never for more than one or two days. Winter highs in Delhi range from 16 to 21 °C (61 to 70 °F). Nighttime temperatures average 2–8 °C (36–46 °F). In the plains of Punjab, lows can fall below freezing, dropping to around −3 °C (27 °F) in Amritsar. Frost sometimes occurs, but the hallmark of the season is the notorious fog, which frequently disrupts daily life; fog grows thick enough to hinder visibility and disrupt air travel 15–20 days annually. In Bihar in middle of the Ganges plain, hot weather sets in and the summer lasts until the middle of June. The highest temperature is often registered in May which is the hottest time. Like the rest of the north, Bihar also experiences dust-storms, thunderstorms and dust raising winds during the hot season. Dust storms having a velocity of 48–64 km/h (30–40 mph) are most frequent in May and with second maximum in April and June. The hot winds (loo) of Bihar plains blow during April and May with an average velocity of 8–16 km/h (5–10 mph). These hot winds greatly affect human comfort during this season. Rain follows. The rainy season begins in June. The rainiest months are July and August. The rains are the gifts of the southwest monsoon. There are in Bihar three distinct areas where rainfall exceeds 1,800 mm (71 in). Two of them are in the northern and northwestern portions of the state; the third lies in the area around Netarhat. The southwest monsoon normally withdraws from Bihar in the first week of October. Eastern India's climate is much milder, experiencing moderately warm days and cool nights. Highs range from 23 °C (73 °F) in Patna to 26 °C (79 °F) in Kolkata (Calcutta); lows average from 9 °C (48 °F) in Patna to 14 °C (57 °F) in Kolkata. In Madhya

Pradesh which is towards the south-western side of the Gangetic Plain similar conditions prevail albeit with much less humidity levels. Capital Bhopal averages low of 9 °C (48 °F) and high of 24 °C (75 °F).

Frigid winds from the Himalayas can depress temperatures near the Brahmaputra River. The Himalayas have a profound effect on the climate of the Indian subcontinent and the Tibetan plateau by preventing frigid and dry Arctic winds from blowing south into the subcontinent, which keeps South Asia much warmer than corresponding temperate regions in the other continents. It also forms a barrier for the monsoon winds, keeping them from travelling northwards, and causing heavy rainfall in the Terai region instead. The Himalayas are indeed believed to play an important role in the formation of Central Asian deserts such as the Taklamakan and Gobi. The mountain ranges prevent western winter disturbances in Iran from travelling further east, resulting in much snow in Kashmir and rainfall for parts of Punjab and northern India. Despite the Himalayas being a barrier to the cold northerly winter winds, the Brahmaputra valley receives part of the frigid winds, thus lowering the temperature in Northeast India and Bangladesh. The Himalayas, which are often called "The Roof of the World", contain the greatest area of glaciers and permafrost outside of the poles. Ten of Asia's largest rivers flow from there. The two Himalayan states in the east, Sikkim and Arunachal Pradesh, receive substantial snowfall. The extreme north of West Bengal cantered on Darjeeling experiences snowfall, but only rarely.

In South India, particularly the hinterlands of Maharashtra, parts of Karnataka, and Andhra Pradesh, somewhat cooler weather prevails. Minimum temperatures in western Maharashtra and Chhattisgarh hover around 10 °C (50 °F); in the southern Deccan Plateau, they reach 16 °C (61 °F). Coastal areas—especially those near the Coromandel Coast and adjacent low-elevation interior tracts—are warm, with daily high temperatures of 30 °C (86 °F) and lows of around 21 °C (70 °F). The Western Ghats, including the Nilgiri Range, are exceptional; lows there can fall below freezing. This compares with a range of 12–14 °C (54–57 °F) on the Malabar Coast; there, as is the case for other coastal areas, the Indian Ocean exerts a strong moderating influence on weather. The region averages 800 millimetres (31 in) per year, most of which falls between October and December. The topography of the Bay of Bengal and the staggered weather pattern prevalent during the season favours the northeast monsoon, which has a tendency to cause cyclones and hurricanes rather than steady precipitation. As a result, the coast is hit by what can mildly be termed as inclement weather almost every year between October and January.

Summer

Summer in northwestern India starts from April and ends in July, and in the rest of the country from March to May. The temperatures in the north rise as the vertical rays of the Sun reach the Tropic of Cancer. The hottest month for the western and southern regions of the country is April; for most of North India, it is May. Temperatures of 50 °C (122 °F) and higher have been recorded in parts of India during this season. Another striking feature of summer is the Loo (wind). These are strong, gusty, hot,

dry winds that blow during the day in India. Direct exposure to these winds may be fatal. In cooler regions of North India, immense pre-monsoon squall-line thunderstorms, known locally as "Nor 'westers", commonly drop large hailstones. In Himachal Pradesh, Summer lasts from mid-April till the end of June and most parts become very hot (except in alpine zone which experience mild summer) with the average temperature ranging from 28 °C (82 °F) to 32 °C (90 °F). Winter lasts from late November till mid-March. Snowfall is generally common in alpine tracts that are above 2,200 meters (7,218 ft), especially those in the higher- and trans-Himalayan regions. Near the coast the temperature hovers around 36 °C (97 °F), and the proximity of the sea increases the level of humidity. In southern India, the temperatures are higher on the east coast by a few degrees compared to the west coast.

By May, most of the Indian interior experiences mean temperatures over 32 °C (90 °F), while maximum temperatures often exceed 40 °C (104 °F). In the hot months of April and May, western disturbances, with their cooling influence, may still arrive, but rapidly diminish in frequency as summer progresses. Notably, a higher frequency of such disturbances in April correlates with a delayed monsoon onset (thus extending summer) in northwest India. In eastern India, monsoon onset dates have been steadily advancing over the past several decades, resulting in shorter summers there.

Altitude affects the temperature to a large extent, with higher parts of the Deccan Plateau and other areas being relatively cooler. Hill stations, such as Ootacamund ("Ooty") in the Western Ghats and Kalimpong in the eastern Himalayas, with average maximum temperatures of around 25 °C (77 °F), offer some respite from the heat. At lower elevations, in parts of northern and western India, a strong, hot, and dry wind known as the loo blows in from the west during the daytime; with very high temperatures, in some cases up to around 45 °C (113 °F); it can cause fatal cases of sunstroke. Tornadoes may also occur, concentrated in a corridor stretching from northeastern India towards Pakistan. They are rare, however; only several dozen have been reported since 1835.

Monsoon

The southwest summer monsoon, a four-month period when massive convective thunderstorms dominate India's weather, is Earth's most productive wet season. A product of southeast trade winds originating from a high-pressure mass cantered over the southern Indian Ocean, the monsoonal torrents supply over 80% of India's annual rainfall. Attracted by a low-pressure region cantered over South Asia, the mass spawns surface winds that ferry humid air into India from the southwest. These inflows ultimately result from a northward shift of the local jet stream, which itself results from rising summer temperatures over Tibet and the Indian subcontinent. The void left by the jet stream, which switches from a route just south of the Himalayas to one tracking north of Tibet, then attracts warm, humid air.

The main factor behind this shift is the high summer temperature difference between Central Asia and the Indian Ocean. This is accompanied by a seasonal excursion of the normally equatorial

intertropical convergence zone (ITCZ), a low-pressure belt of highly unstable weather, northward towards India. This system intensified to its present strength as a result of the Tibetan Plateau's uplift, which accompanied the Eocene–Oligocene transition event, a major episode of global cooling and aridification which occurred 34–49 Ma.

The southwest monsoon arrives in two branches: The Bay of Bengal branch and the Arabian Sea branch. The latter extends towards a low-pressure area over the Thar Desert and is roughly three times stronger than the Bay of Bengal branch. The monsoon typically breaks over Indian territory by around 25 May, when it lashes the Andaman and Nicobar Islands in the Bay of Bengal. It strikes the Indian mainland around 1 June near the Malabar Coast of Kerala. By 9 June, it reaches Mumbai; it appears over Delhi by 29 June. The Bay of Bengal branch, which initially tracks the Coromandel Coast northeast from Cape Comorin to Orissa, swerves to the northwest towards the Indo-Gangetic Plain. The Arabian Sea branch moves northeast towards the Himalayas. By the first week of July, the entire country experiences monsoon rain; on average, South India receives more rainfall than North India. However, Northeast India receives the most precipitation. Monsoon clouds begin retreating from North India by the end of August; it withdraws from Mumbai by 5 October. As India further cools during September, the southwest monsoon weakens. By the end of November, it has left the country.

Monsoon rains impact the health of the Indian economy; as Indian agriculture employs 600 million people and comprises 20% of the national GDP, good monsoons correlate with a booming economy. Weak or failed monsoons (droughts) result in widespread agricultural losses and substantially hinder overall economic growth. Yet such rains reduce temperatures and can replenish groundwater tables, rivers.

Post-monsoon

During the post-monsoon months of October to December, a different monsoon cycle, the northeast (or "retreating") monsoon, brings dry, cool, and dense air masses to large parts of India. It is called autumn. Winds spill across the Himalayas and flow to the southwest across the country, resulting in clear, sunny skies. Though the India Meteorological Department (IMD) and other sources refers to this period as a fourth ("post-monsoon") season, other sources designate only three seasons. Depending on location, this period lasts from October to November, after the southwest monsoon has peaked. Less and less precipitation falls, and vegetation begins to dry out. In most parts of India, this period marks the transition from wet to dry seasonal conditions. Average daily maximum temperatures range between 28 and 34 °C (82 and 93 °F).

The northeast monsoon, which begins in September, lasts through the post-monsoon seasons, and only ends in March. It carries winds that have already lost their moisture out to the ocean (opposite from the summer monsoon). They cross India diagonally from northeast to southwest. However, the large indentation made by the Bay of Bengal into India's eastern coast means that the flows are humidified before reaching Cape Comorin and rest of Tamil Nadu, meaning that the state, and also some parts of Kerala, experience significant precipitation in the post-monsoon and winter periods.

However, parts of West Bengal, Orissa, Andhra Pradesh, Karnataka and Mumbai also receive minor precipitation from the north-east monsoon.

10. Indian agricultural product export

As of 2011, India had a large and diverse agricultural sector, accounting, on average, for about 16% of GDP and 10% of export earnings. India's arable land area of 159.7 million hectares (394.6 million acres) is the second largest in the world, after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world. India is among the top three global producers of many crops, including wheat, rice, pulses, cotton, peanuts, fruits and vegetables. Worldwide, as of 2011, India had the largest herds of buffalo and cattle, is the largest producer of milk and has one of the largest and fastest growing poultry industries.

Major crops and yields

The following table presents the 20 most important agricultural products in India, by economic value, in 2009. Included in the table is the average productivity of India's farms for each produce. For context and comparison, included is the average of the most productive farms in the world and name of country where the most productive farms existed in 2010. The table suggests India has large potential for further accomplishments from productivity increases, in increased agricultural output and agricultural incomes.

Largest agricultural products in India by value

Rank	Commodity	Value (US$, 2013)	Unit price (US$ / kilogram, 2009)	Average yield (tonnes per hectare, 2010)	Most productive country (tonnes per hectare, 2010)	
1	Rice	$42.57 billion	0.27	3.99	12.03	Australia
2	Buffalo milk	$27.92 billion	0.4	0.63	23.7	India
3	Cow milk	$18.91 billion	0.31	1.2	10.3	Israel
4	Wheat	$13.98 billion	0.15	2.8	8.9	Netherlands
5	Mangoes, guavas	$10.79 billion	0.6	6.3	40.6	Cape Verde
6	Sugar cane	$10.42 billion	0.03	66	125	Peru
7	Cotton	$8.65 billion	1.43	1.6	4.6	Israel
8	Bananas	$7.77 billion	0.28	37.8	59.3	Indonesia
9	Potatoes	$7.11 billion	0.15	19.9	44.3	United States
10	Tomatoes	$6.74 billion	0.37	19.3	524.9	Belgium

11	Fresh vegetables	$6.27 billion	0.19	13.4	76.8	United States
12	Buffalo meat	$4.33 billion	2.69	0.138	0.424	Thailand
13	Groundnuts	$4.11 billion	1.96	1.8	17.0	China
14	Okra	$4.06 billion	0.35	7.6	23.9	Israel
15	Onions	$4.05 billion	0.21	16.6	67.3	Ireland
16	Chick peas	$3.43 billion	0.4	0.9	2.8	China
17	Chicken meat	$3.32 billion	0.64	10.6	20.2	Cyprus
18	Fresh fruits	$3.25 billion	0.42	1.1	5.5	Nicaragua
19	Hen eggs	$3.18 billion	2.7	0.1	0.42	Japan
20	Soybeans	$3.09 billion	0.26	1.1	3.7	Turkey

The Statistics Office of the Food and Agriculture Organization reported that, per final numbers for 2009, India had grown to become the world's largest producer of the following agricultural products:

- Fresh Fruit
- Lemons and limes
- Buffalo milk, whole, fresh
- Castor oil seeds
- Sunflower seeds
- Sorghum
- Millet
- Spices
- Okra
- Jute
- Beeswax
- Bananas
- Mangoes, mangosteens, guavas
- Pulses
- Indigenous buffalo meat
- Fruit, tropical
- Ginger
- Chick peas
- Areca nuts
- Other bastfibres
- Pigeon peas
- Papayas
- Chillies and peppers, dry
- Anise, badian, fennel, coriander
- Goat milk, whole, fresh

Per final numbers for 2009, India is the world's second largest producer of the following agricultural products:

- Wheat
- Rice
- Fresh vegetables
- Sugar cane
- Groundnuts, with shell
- Lentils
- Garlic
- Cauliflowers and broccoli
- Peas, green
- Sesame seed
- Cashew nuts, with shell
- Silk-worm cocoons, reelable

- Cow milk, whole, fresh
- Tea
- Potatoes
- Onions
- Cotton lint
- Cotton seed
- Eggplants (aubergines)
- Nutmeg, mace and cardamoms
- Indigenous goat meat
- Cabbages and other brassicas
- Pumpkins, squash and gourds

In 2009, India was the world's third largest producer of eggs, oranges, coconuts, tomatoes, peas and beans.

In addition to growth in total output, agriculture in India has shown an increase in average agricultural output per hectare in last 60 years. The table below presents average farm productivity in India over three farming years for some crops. Improving road and power generation infrastructure, knowledge gains and reforms has allowed India to increase farm productivity between 40% to 500% over 40 years. India's recent accomplishments in crop yields while being impressive, are still just 30% to 60% of the best crop yields achievable in the farms of developed as well as other developing countries. Additionally, despite these gains in farm productivity, losses after harvest due to poor infrastructure and unorganized retail cause India to experience some of the highest food losses in the world.

Agriculture productivity in India, growth in average yields from 1970 to 2010

Crop	**Average YIELD, 1970-1971**	**Average YIELD, 1990-1991**	**Average YIELD, 2010–2011**
	kilogram per hectare	kilogram per hectare	kilogram per hectare
Rice	1123	1740	2240
Wheat	1307	2281	2938
Pulses	524	578	689
Oilseeds	579	771	1325
Sugarcane	48322	65395	68596
Tea	1182	1652	1669
Cotton	106	225	510

India and China are competing to establish the world record on rice yields. Yuan Longping of China National Hybrid Rice Research and Development Centre set a world record for rice yield in 2010 at 19 tonnes per hectare in a demonstration plot. In 2011, this record was surpassed by an Indian farmer, Sumanth Kumar, with 22.4 tonnes per hectare in Bihar, also in a demonstration plot. These farmers claim to have employed newly developed rice breeds and system of rice intensification (SRI), a recent innovation in farming. The claimed Chinese and Indian yields have yet to be demonstrated on 7-hectare farm lots and that these are reproducible over two consecutive years on the same farm.

Productivity

Although India has attained self-sufficiency in food staples, the productivity of its farms is below that of Brazil, the United States, France and other nations. Indian wheat farms, for example, produce about a third of the wheat per hectare per year compared to farms in France. Rice productivity in India was less than half that of China. Another staples productivity in India is similarly low. Indian total factor productivity growth remains below 2% per annum; in contrast, China's total factor productivity growths is about 6% per annum, even though China also has smallholding farmers. Several studies suggest India could eradicate its hunger and malnutrition and be a major source of food for the world by achieving productivity comparable with other countries.

By contrast, Indian farms in some regions post the best yields, for sugarcane, cassava and tea crops.

Crop yields vary significantly between Indian states. Some states produce two to three times more grain per acre than others. The table compares the statewide average yields for a few major agricultural crops in India, for 2001-2002.

Crop	**Average farm yield in Bihar**	**Average farm yield in Karnataka**	**Average farm yield in Punjab**
	kilogram per hectare	kilogram per hectare	kilogram per hectare
Wheat	2020	unknown	3880
Rice	1370	2380	3130
Pulses	610	470	820
Oil seeds	620	680	1200
Sugarcane	45510	79560	65300

Crop yields for some farms in India are within 90% of the best achieved yields by farms in developed countries such as the United States and in European Union. No single state of India is best in every crop. Tamil Nadu achieved highest yields in rice and sugarcane, Haryana in wheat and coarse grains, Karnataka in cotton, Bihar in pulses, while other states do well in horticulture, aquaculture, flower and fruit plantations. These differences in agricultural productivity are a function of local infrastructure, soil quality, micro-climates, local resources, farmer knowledge and innovations.

The Indian food distribution system is highly inefficient. Movement of agricultural produce is heavily regulated, with inter-state and even inter-district restrictions on marketing and movement of agricultural goods.

One study suggests Indian agricultural policy should best focus on improving rural infrastructure primarily in the form of irrigation and flood control infrastructure, knowledge transfer of better yielding and more disease resistant seeds. Additionally, cold storage, hygienic food packaging and efficient modern retail to reduce waste can improve output and rural incomes.

The low productivity in India is a result of the following factors:

- The average size of land holdings is very small (less than 2 hectares) and is subject to fragmentation due to land ceiling acts, and in some cases, family disputes. Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labour. Some reports claim smallholder farming may not because of poor productivity, since the productivity is higher in China and many developing economies even though China smallholder farmers constitute over 97% of its farming population. A Chinese smallholder farmer is able to rent his land to larger farmers, China's organized retail and extensive Chinese highways are able to provide the incentive and infrastructure necessary to its farmers for sharp increases in farm productivity.
- Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs and impracticality in the case of small land holdings.
- According to the World Bank, Indian branch's Priorities for Agriculture and Rural Development, India's large agricultural subsidies are hampering productivity-enhancing investment. Overregulation of agriculture has increased costs, price risks and uncertainty. Government intervenes in labour, land, and credit markets. India has inadequate infrastructure and services. The World Bank also says that the allocation of water is inefficient, unsustainable and inequitable. The irrigation infrastructure is deteriorating. The overuse of water is being covered by over-pumping aquifers but, as these are falling by one foot of groundwater each year, this is a limited resource. The Intergovernmental Panel on Climate Change released a report that food security may be a big problem in the region post 2030.
- Illiteracy, general socio-economic backwardness, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce.
- Inconsistent government policy. Agricultural subsidies and taxes are often changed without notice for short term political ends.
- Irrigation facilities are inadequate, as revealed by the fact that only 52.6% of the land was irrigated in 2003–04, which result in farmers still being dependent on rainfall, specifically the monsoon season. A good monsoon results in a robust growth for the economy, while a poor monsoon leads to a sluggish growth. Farm credit is regulated by NABARD, which is the statutory apex agent for rural development in the subcontinent. At the same time, over-pumping made possible by subsidized electric power is leading to an alarming drop in aquifer levels.
- A third of all food that is produced rots due to inefficient supply chains and the use of the "Walmart model" to improve efficiency is blocked by laws against foreign investment in the retail sector.

Farmer suicides

In 2012, the National Crime Records Bureau of India reported 13,754 farmer suicides. Farmer suicides account for 11.2% of all suicides in India. Activists and scholars have offered a number of conflicting reasons for farmer suicides, such as monsoon failure, high debt burdens, genetically modified crops, government policies, public mental health, personal issues and family problems.

Notes: